

## REMARKS

By this Amendment, Applicants have amended claims 1, 13, and 15. Accordingly, claims 1-15 are now pending for the Examiner's consideration. The amendments to page 1 of the specification has been made to bring the specification into formal compliance with 37 C.F.R. § 1.78(a)(2). The Abstract has been amended to correct a minor typographical error. The amendments are fully supported by the specification and original claims as filed. Accordingly, favorable reconsideration of the pending claims is respectfully requested.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached pages are captioned "**VERSION WITH MARKINGS TO SHOW CHANGES MADE.**"

### 1. Rejections Under 35 U.S.C. § 112

Claims 1-15 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point and distinctly claim the subject matter which Applicants regard as the invention. In particular, the Examiner has indicated that the following terminology renders claims 1, 13, and 15 indefinite: "containing substances", "critical fluid medium", "alcohol input", "water input", and "alcohol and 'final products' catalyst." Claim 2 is indicated as indefinite for the term "short chain alkyl group" and claims 4, 6, and 7 are indicated as indefinite for the terms "liquid catalyst", "acid liquid catalyst", and "base liquid catalyst." Finally, claims 5 and 8 are indicated as indefinite for the terms "solid catalyst" and "inorganic oxide." Applicants respectfully traverse.

Support for the term "containing substances" can be found on page 5, lines 3-21 of the specification as filed. Further, as recited in claims 1, 13, and 15, as well as where indicated in the

Specification, the term "containing substances" does not stand alone, but is part of the term "triglyceride- and fatty acid- containing substances." Accordingly, Applicants respectfully submit the term is definite.

Support for the term "critical fluid medium" can be found on page 3, line 22 to page 4, line 5 and on page 8, lines 14-20 of the specification. The application defines critical fluids as substances that have a temperature within 20% of the critical temperature of the fluid as measured in Kelvin and a pressure within 0.5-15 times the critical pressure. Accordingly, a "critical fluid medium" is a critical fluid having the above characteristics. Any suitable material may provide a critical fluid medium, depending on the process parameters of the given reaction.

Regarding the terms "alcohol input" and "water input," claims 1, 13, and 15 have been amended to clarify that alcohol or water is dissolved into the critical fluid.

Regarding the terms "alcohol" and "final products" catalyst, claims 1, 13, and 15 have been amended to properly recite the antecedent basis for the alcohol or water. Additionally, the term alcohol is definite because it refers to a well known type of compound and the terms catalyst and final products are definite since they are well known in the art as elements in a reaction process.

Regarding the term "short chain alkyl group" support can be found on page 7, lines 11-13 of the specification. Further, the term "short chain" is defined on page 6, line 18 as a molecule having one to four carbon atoms in the chain. The term alkyl is well known in the art to indicate simple hydrocarbons wherein one hydrogen atom is removed, i.e.  $\text{CH}_3$ . Accordingly, the term "short chain alkyl group" would be clear to one skilled in the art.

Regarding the terms "liquid catalyst," "acid liquid catalyst," "base liquid catalyst," "solid catalyst," and "inorganic oxide" support can be found on page 9, lines 11-21 of the specification.

Applicants believe the support therein provides definiteness to these terms.

Accordingly, Applicants respectfully request that the rejection of the claims under 35 U.S.C. § 112 be withdrawn.

2. Rejections Under 35 U.S.C. § 103(a)

Claims 1-15 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,520,708 to Johnson et al. (hereinafter "*Johnson*"), combined with U.S. Patent No. 4,695,411 to Stern et al. (hereinafter "*Stern*") or U.S. Patent No. 5,578,090 to Bradin (hereinafter "*Bradin*") in view of JP 09157684A Abstract (hereinafter "*JP '684*") and JP 63112536A (hereinafter "*JP '536*"). Applicants respectfully traverse this rejection.

The Office Action cites *Johnson*, *Stern*, and *Bradin* for teaching the basic reactions recited in the claims of the present application, and cites the *JP '684* and *JP '536* publications for teaching the solubility effects of critical fluids. However, Applicants respectfully point out that the *JP '684* and *JP '536* publications are directed to solubility effects in performing purifications and separations, not reactions. Teaching solubility alone is not enough alone to promote a more advantageous reaction. For example, fats and oils are also soluble in hexane, but hexane would be a poor reactant medium due to mass transfer limitations. Therefore, because the *JP '684* and *JP '536* publications teach solubility phenomena only and do not teach any chemical reaction advantages or mass transport advantages, one skilled in the art would not be motivated to combine the *JP '684* and *JP '536* publications with *Johnson*, *Stern*, or *Bradin*.

Conventional biodiesel reaction conditions, such as those cited in the Office Action, all suffer in one fashion or another from physical or chemical limitations brought on by the reaction solvent and reaction conditions employed. In response to the resultant need for improved processes, the present invention teaches use of critical fluids in reacting triglycerides and free fatty acids to add solubility benefits, increase reaction rates, decrease the loss of catalytic activity, eliminate mass transfer limitations, reduce the quantity of excess reactants required, allow a wide range of catalysts, limit side reactions, and enable clean efficient separations. (See Specification, at pages 1 and 4). In addition, the use of a critical fluid also provides the advantages of reducing catalyst coking, reducing water deactivation of catalyst function, limiting water content in the reaction solvent, removing water from the reaction equilibrium, removing glycerol product from the reaction equilibrium, promoting more efficient bi-molecular interactions, and controlling the rate of reaction to the limit of diffusivity. Of these advantages, only solubility is demonstrated or taught in any of the cited references. As a result, the present invention provides a process with advantages that go far beyond mere solubility, which alone would not motivate one skilled in the art to use critical fluids for a reaction medium. Although impermissible hindsight suggests that critical fluids would make advantageous mediums for the present reactions, such was not known in the art at the time of the present invention.

Accordingly, Applicants submit that the claims are patentable for the reasons presented hereinabove and request that the rejection of the claims under 35 U.S.C. § 103(a) be withdrawn.

CONCLUSION

In view of the foregoing, Applicants respectfully request reconsideration and allowance of the present claims. In the event the Examiner finds any remaining impediment to the prompt allowance of this application which could be clarified by a telephone interview, the Examiner is respectfully requested to contact the undersigned attorney.

RESPECTFULLY SUBMITTED,

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**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**IN THE SPECIFICATION:**

The following text has been added to the specification beginning at page 1, line 3:

This application claims priority from PCT application S/N PCT/US99/16669 filed July 22, 1999, published internationally under PCT Article 21(2) in English, which claims priority from United States provisional application S/N 60/094,076 filed July 24, 1998.

The following text has been deleted from the specification at page 1, lines 10-13.

**[RELATED APPLICATION**

This application claims priority from PCT application S/N PCT/US99/16669 filed July 22, 1999 which claims priority from United States provisional application S/N 60/094,076 filed July 24, 1998.]

The Abstract, beginning at line 1 of page 15 has been amended as follows:

A process for producing alkyl esters useful in biofuels and lubricants by transesterifying glyceride- or esterifying free fatty acid- containing substances in a single critical phase medium is disclosed. The critical phase medium [provide] provides increased reaction rates, decreases the loss of catalyst or catalyst activity and improves the overall yield of desired product. The process involves the steps of dissolving an input glyceride- or free fatty acid- containing substance with an alcohol or water into a critical fluid medium; reacting the glyceride- or free fatty acid- containing substance with the alcohol or water input over either a solid or liquid acidic or basic catalyst and sequentially separating the products from each other and from the critical fluid medium, which



critical fluid medium can then be recycled back in the process. The process significantly reduces the cost of producing additives or alternatives to automotive fuels and lubricants utilizing inexpensive glyceride- or free fatty acid- containing substances, such as animal fats, vegetable oils, rendered fats, and restaurant grease.

#### IN THE CLAIMS:

Claims 1, 13, and 15 have been amended as follows:

1. (Once amended) A process for producing alkyl esters useful in biofuels and lubricants by reacting glyceride- or free fatty acid- containing substances in a critical fluid medium, said process comprising the steps of:

(a) dissolving the glyceride- or free acid- containing substance and an alcohol or water [input] into a critical fluid; and

(b) reacting the glyceride- or free fatty acid- containing substance with the [an] alcohol or water in the presence of a catalyst to produce final products.

13. (Once amended) A process for producing alkyl esters useful in biofuels and lubricants by reacting a glyceride- containing substance in a critical fluid medium, said process comprising the steps of:

(a) dissolving a glyceride- containing substance and an alcohol or water [input] into a critical fluid; [and]

(b) reacting the glyceride- containing substance and the alcohol or water [input] in a reactor in the presence of a catalyst to produce final products; and

(c) separating an alkyl ester product and a glycerol product from the reaction mixture.

15. (Once amended) A process for reacting fatty acids in a critical fluid medium, said process comprising the steps of:

(a) dissolving a fatty acid- containing substance and an alcohol or water [input] into a critical fluid; [and]

(b) reacting the fatty acid- containing substance and the [an] alcohol or water [input] in a reactor in the presence of a catalyst to produce final products; and

(c) separating an alcohol ester product and a glycerol product from the reaction mixture.